Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper	Mark Scheme	Principal Examiner's Report
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

MATHEMATICS

Paper 0580/01

Paper 1 (Core)

General comments

Overall the standard of responses from candidates was worse than in recent years. There were a comparatively large number of candidates scoring very low marks and some cases of no marks whatsoever. On this paper there were enough straightforward questions requiring only very basic mathematical ability for all candidates properly prepared for the examination to answer.

Naturally there were some very good scripts, with clear working and methods shown, but many more cases were found of lack of working, and little or no understanding of what was required in the questions. With many cases of answers only written, it is supposed that some candidates were allowed rough working paper. This is not permitted and the candidate is at a disadvantage if working is not seen in the space after the question. Without evident progress towards a solution in the working area or on diagrams, method marks cannot be gained. Wherever a question or part of a question has more than 1 mark, there was credit available even if the final answer was incorrect, but without working shown these marks could not be gained.

There was again this year evidence of poor use of calculators and in some cases it was clear that candidates did not have a calculator at all. This is a requirement of the paper.

Many candidates may not have achieved as high a grade as expected due to poor examination technique. Simple checks of whether answers are sensible in the context seem not to have been done by the vast majority. There was no significant evidence of shortage of time and so many candidates clearly did not make use of the full hour of the examination.

Comments on specific questions

Question 1

Although this question was generally answered well, many candidates did not appear to understand that colder than –2 would be further down the negative scale. Answers of 13 and –9 were commonly seen. With such simple numbers it would probably be more reliable not to use a calculator for such a question and interpret the wording of the question sensibly.

Answer. –13

Question 2

This was generally well answered and certainly those who started by adding the ratios almost always gained full marks. A common error was to divide by 5 and multiply by 2 to give an answer of 14. Only occasionally was the other amount 25 given as an answer.

Answer. 10

Question 3

Although many better candidates solved the equation correctly, the majority could not correctly sort out the 'x' terms to one side of the equation and the numeric ones to the other. Even when that was achieved there were a significant number of candidates giving the answer 1 instead of –1.

Answer: –1

Question 4

In conversion questions candidates need to think about their answer in context: With the conversion, should the answer be smaller or larger in the required unit? The only significant error, which was evident in about half the scripts, was to multiply instead of divide. With more thought this error could have been avoided.

Answer. 60

Question 5

Apart from those who did not understand the term 'factorise' this question was well done. Some gained 1 mark from a partial factorising, but a common error was to write $2x(2y - x)$. Some spoilt their effort by going on to combine the terms or solve an equation.

Answer. $2x(2y - 1)$

Question 6

The trigonometry questions were not well done and it was clear that many did not understand what was required. Using Pythagoras' theorem and giving the hypotenuse as the answer was common. Incorrect trigonometrical ratios used indicated lack of knowledge, and premature approximation of the division answer often resulted in loss of accuracy. Once again there were a small number who had not checked that their calculator was set for degrees, instead of rads or grads, and consequently they lost the accuracy mark.

Answer. Answer rounds to 39.8

Question 7

Although many did get this correct, it is still a topic that weaker candidates find extremely difficult. All that was required was to halve the 100 and add and subtract it from 1300. Pairings such as '100 and 1300', '1200 and 1400' and '1295 and 1305' were seen as well as even the names of the 2 cities. A few lost a mark by reversing the correct values but 1249.999 and 1349.999 were only rarely seen.

Answer. $1250 \le d \le 1350$

Question 8

(a) This mark was gained by most candidates but some lost it by only giving one line of symmetry. The other main cause of losing the mark was to give a very short vertical line, which needed to be at least the height of the figure.

In contrast, part **(b)** was very rarely correct although nearly all attempted the part. It was surprising that very few attempted to draw a shape with the given symmetry properties in order to work out the name. As the question stated it was a quadrilateral, it was surprising that so few wrote down the correct name.

Answers: **(a)** Two correct lines **(b)** Parallelogram

Question 9

The question was done well and in particular few failed to get part **(a)** correct. Surprisingly, many did not make use of part **(a)** when finding a denominator for part **(b)**, although full marks could still be gained provided a clear recognition of the equivalent fractions was evident. A considerable number of candidates could gain a mark by changing the mixed number to a fraction but then did not know how to proceed. Candidates who attempted converting all to decimals (hence using a calculator) did not gain any marks.

Answers: **(a)** 15 **(b)** $\frac{11}{9} - \frac{15}{18} = \frac{22}{18} - \frac{15}{18} = \frac{7}{18}$ or equivalent

Question 10

There was considerable misunderstanding of terms related to polygons, with many candidates seemingly not knowing the word 'exterior'. Subtraction from 360° in part **(a)** was the most common error although many other answers were offered. Very few realised that the sum of the exterior angles was 360° and hence had no idea how to find the number of sides. The question was a little unusual in that most often it is the interior angle being asked for, having been given the number of sides. Consequently few candidates scored on the question, and of those who did score very few gained the 3 marks.

Answers: **(a)** 30 **(b)** 12

Question 11

Again the meaning of what was required in this question was beyond the vast majority of candidates. The required use of trigonometry was not realised with most having the impression that it was simply a question on bearings. Of those who realised trigonometry ratios were needed, a significant number found the distance east instead of south. Only the more able candidates found the correct solution on this question. The calculator in grads or rads was also evident occasionally.

Answer. 38.3

Question 12

This was another question on the paper where part **(a)** was included to help candidates to find the equation in part **(b)**. Clearly very many did not connect the two parts. In part **(a)** the negative sign was often missing and swapping x and y axes also lost the mark. Many candidates did not know what m and c meant and could not put even the incorrect gradient into the formula. Some tried to put a formula still containing the letter m, such as $y = -3m + 3$ which did not score.

Answers: **(a)** –3 **(b)** $(y =) -3x + 3$

Question 13

In general this question was very well done with many of the weaker candidates gaining marks. A significant error in part **(a)** was to re-interpret the question as asking for the percentage of 'not girls'. Also common was truncating the answer of 54.58% to 54.5%. Part **(b)** was the best done question on the paper but there were still quite a number who assumed the question was asking for the number present. The addition of a percentage sign to the answer, though incorrect, was not penalised.

Answers: **(a)** 55 or an answer rounding to 54.6 **(b)** 15

Question 14

Many candidates were not clear about the formula for circumference of a circle. Some confused it with area and others halved or doubled the diameter before multiplying by π, possibly confused by a semicircle diagram in part **(b)**. The recognition of the property of angle in a semicircle being 90° was clearly not appreciated by many although a considerable number did use it to find the correct answer. An answer of 151° was commonly seen.

Answers: **(a)** 25.1 **(b)** 61°

Question 15

(a) The question occurs quite often and was answered well. However, there were more frequent answers of 0 or *a*.

(b) The most common error was to give the answer of x^5 but most found the correct power.

(c) This was quite difficult and beyond the ability of most candidates. However there were quite a significant number who gained at least 1 mark either from getting as far as $\frac{1}{\left(\frac{3}{x}\right)^2}$ or correctly finding the numerator or denominator.

Answers: **(a)** 1 **(b)** x^6 **(c)** $\frac{x^2}{9}$

Question 16

In part **(a)(i)** many gave answers of 18 or even 17 showing no recognition of place value. Also standard form in part **(a)(ii)** was not understood by many candidates. It was also common to see an attempt to put 17 598 into standard form rather than the answer to part **(a)(i)** as was stated in the question. Part **(b)** was answered better than part **(a)** although this was mainly due to many gaining 1 mark most often from correctly handling the negative power of 10. Some did not understand what was meant by 'writing as a decimal'.

Answers: **(a)(i)** 18 000 **(a)(ii)** 1.8×10^4 **(b)** 0.056

Question 17

Although part **(a)** was quite well done, there were a significant number who only calculated the interest for 1 year or used time in months instead of years. Compound interest has been on the syllabus since 2006 but it was clear that most candidates had not experienced it. Part **(b)** was more often than not treated as simple interest, even though compound was in bold.

Again, incorrect reading of the question, as both parts asked for the interest and not the amount they had after two years, resulted in mark loss for quite a number of candidates.

Answers: **(a)** 16.2(0) **(b)** 16.3(2) or 16.3(0)

Question 18

Many candidates did not attempt to draw any vector in part **(a)(i)** and also many were incorrect or too long. The coordinates of *L* were often correct even without the vector drawn. This mark was often gained by follow through from a marked incorrect point *L*. In part **(b)** many gained a mark by correctly multiplying the vector by 2 but the error of only multiplying the first component was often seen. Many could not interpret this on the diagram in order to find the correct coordinates.

Answers: **(a)(i)** Vector from (3, –1) to (0, 2) **(a)(ii)** (0, 2) **(b)** (1, –1)

Question 19

Although many candidates did not attempt this question it was not felt that this was due to lack of time. Otherwise the first part was well answered with most understanding that speed is distance divided by time. Unfortunately 1200/20 was often seen without the division being done. Part **(a)(ii)** was not well done with many candidates confused about how to convert to other units. Attempts to go back to the graph and identify 1.2 kilometres and $\frac{1}{3}$ hour were not often successful. Many gained a mark in part **(b)** for recognising the need to divide a distance by a time but lack of knowledge of conversions lost the other mark. 30 minutes was often stated as 0.3 hour and 1200 metres was often 12 kilometres. However, this was a question where the better candidates scored well.

Answers: **(a)(i)** 60 **(a)(ii)** 3.6 **(b)** 3

MATHEMATICS

Paper 0580/01
Paper 1 (Core)

General comments

Overall the standard of responses from candidates was worse than in recent years. There were a comparatively large number of candidates scoring very low marks and some cases of no marks whatsoever scored. On this paper there were enough straightforward questions requiring only very basic mathematical ability for all candidates properly prepared for the examination to answer.

Naturally there were some very good scripts, with clear working and methods shown, but many more cases were found of lack of working, and little or no understanding of what was required in the questions. With many cases of answers only written, it is supposed that some candidates were allowed rough working paper. This is not permitted and the candidate is at a disadvantage if working is not seen in the space after the question. Without evident progress towards a solution in the working area or on diagrams, method marks cannot be gained. Wherever a question or part of a question has more than 1 mark, there was credit available even if the final answer was incorrect, but without working shown these marks could not be gained.

There was again this year evidence of poor use of calculators and in some cases it was clear that candidates did not have a calculator at all. This is a requirement of the paper.

Many candidates may not have achieved as high a grade as expected due to poor examination technique. Simple checks of whether answers are sensible in the context seem not to have been done by the vast majority. There was no significant evidence of shortage of time and so many candidates clearly did not make use of the full hour of the examination.

Comments on specific questions

Question 1

Although this question was generally answered well, many candidates did not appear to understand that colder than –3 would be further down the negative scale. Answers of 12 and –6 were commonly seen. With such simple numbers it would probably be more reliable to not use a calculator for such a question and interpret the wording of the question sensibly.

Answer. –12

Question 2

This was generally well answered and certainly those who started by adding the ratios almost always gained full marks.

Answer. 25

Question 3

Although many better candidates solved the equation correctly, the majority could not correctly sort out the '*x*' terms to one side of the equation and the numeric ones to the other. Even when that was achieved there were a significant number of candidates giving the answer 2 instead of –2.

Answer. –2

Question 4

In conversion questions candidates need to think about their answer in context: With the conversion, should the answer be smaller or larger in the required unit? The only significant error, which was evident in about half the scripts, was to multiply instead of dividing. With more thought this error could have been avoided.

Answer. 80

Question 5

Apart from those who did not understand the term 'factorise' this question was well done. Some gained 1 mark from a partial factorising, but a common error was to write $2q\ (p - 2q)$. Some spoilt their effort by going on to combine the terms or solve an equation.

Answer. $2q\ (p - 2)$

Question 6

The trigonometry questions were not well done and it was clear that many did not understand what was required. Using Pythagoras' theorem and giving the hypotenuse as the answer was common. Incorrect trigonometrical ratios used indicated lack of knowledge and premature approximation of the division answer often resulted in loss of accuracy. Once again there were a small number who had not checked that their calculator was set for degrees, instead of rads or grads, and consequently they lost the accuracy mark.

Answer. Answer rounds to 34.5

Question 7

Although many did get this correct, it is still a topic that weaker candidates find extremely difficult. All that was required was to halve the 100 and add and subtract it from 8800. Pairings such as '100 and 8800', '8700 and 8900' and '8795 and 8805' were seen as well as even the names of the 2 cities. A few lost a mark by reversing the correct values but 8749.999 and 8849.999 were only rarely seen.

Answer. $8750 \le d \le 8850$

Question 8

(a) This mark was gained by most candidates but some lost it by only giving one line of symmetry. The other main cause of losing the mark was to give a very short vertical line, which needed to be at least the height of the figure.

In contrast part **(b)** was very rarely correct although nearly all attempted the part. It was surprising that very few attempted to draw a shape with the given symmetry properties in order to work out the name. As the question stated it was a quadrilateral, it was surprising that so few wrote down the correct name.

Answers: **(a)** Two correct lines **(b)** Parallelogram

Question 9

The question was done well and in particular few failed to get part **(a)** correct. Surprisingly, many did not make use of part **(a)** when finding a denominator for part **(b)**, although full marks could still be gained provided a clear recognition of the equivalent fractions was evident. A considerable number of candidates could gain a mark by changing the mixed number to a fraction but then did not know how to proceed. Candidates who attempted converting all to decimals (hence using a calculator) did not gain any marks.

Answers: **(a)** 15 **(b)** $\frac{17}{12} - \frac{15}{24} = \frac{34}{24} - \frac{15}{24} = \frac{19}{24}$ or equivalent

Question 10

There was considerable misunderstanding of terms related to polygons, with many candidates seemingly not knowing the word 'exterior'. Subtraction from 360° in part **(a)** was the most common error although many other answers were offered. Very few realised that the sum of the exterior angles was 360° and hence had no idea how to find the number of sides. The question was a little unusual in that most often it is the interior angle being asked for having been given the number of sides. Consequently few candidates scored on the question, and of those who did score very few gained the 3 marks.

Answers: **(a)** 20 **(b)** 18

Question 11

Again the meaning of what was required in this question was beyond the vast majority of candidates. The required use of trigonometry was not realised with most having the impression that it was simply a question on bearings. Of those who realised trigonometry ratios were needed, a significant number found the distance east instead of south. Only the more able candidates found the correct solution on this question. The calculator in grads or rads was also evident occasionally.

Answer. 34.6

Question 12

This was another question on the paper where part **(a)** was included to help candidates to find the equation in part **(b)**. Clearly very many did not connect the two parts. In part **(a)** the negative sign was often missing and swapping x and y axes also lost the mark. Many candidates did not know what m and c meant and could not put even the incorrect gradient into the formula. Some tried to put a formula still containing the letter m, such as $y = –2m + 4$ which did not score.

Answers: **(a)** –2 **(b)** (y =) $–2x + 4$

Question 13

In general this question was very well done with many of the weaker candidates gaining marks. A significant error in part **(a)** was to re-interpret the question as asking for the percentage of 'not girls'. Part **(b)** was the best done question on the paper but there were still quite a number who assumed the question was asking for the number present. The addition of a percentage sign to the answer, though incorrect, was not penalised.

Answers: **(a)** 48 or an answer rounding to 47.8 **(b)** 12

Question 14

Many candidates were not clear about the formula for circumference of a circle. Some confused it with area and others halved or doubled the diameter before multiplying by π, possibly confused by a semicircle diagram in part **(b)**. The recognition of the property of angle in a semicircle being 90° was clearly not appreciated by many although a considerable number did use it to find the correct answer. An answer of 147° was commonly seen.

Answers: **(a)** 40.8 or 40.9 **(b)** 57°

Question 15

(a) The question occurs quite often and was answered well. However, there were more frequent answers of 0 or t.

(b) The most common error was to give the answer of y^6 but most found the correct power.

(c) This was quite difficult and beyond the ability of most candidates. However there were quite a significant number who gained at least 1 mark either from getting as far as $\frac{1}{\left(\frac{5}{p}\right)^2}$ or correctly finding the numerator or denominator.

Answers: **(a)** 1 **(b)** y^8 **(c)** $\frac{p^2}{25}$

Question 16

In part **(a)(i)** many gave answers of 16 or even 15 showing no recognition of place value. Also standard form in part **(a)(ii)** was not understood by many candidates. It was also common to see an attempt to put 15 583 into standard form rather than the answer to part **(a)(i)** as was stated in the question. Part **(b)** was answered better than part **(a)** although this was mainly due to many gaining 1 mark most often from correctly handling the negative power of 10. Some did not understand what was meant by 'writing as a decimal'.

Answers: **(a)(i)** 16 000 **(a)(ii)** 1.6×10^4 **(b)** 0.0037

Question 17

Although part **(a)** was quite well done, there were a significant number who only calculated the interest for 1 year or used time in months instead of years. Compound interest has been on the syllabus since 2006 but it was clear that most candidates had not experienced it. Part **(b)** was more often than not treated as simple interest, even though compound was in bold.

Again, incorrect reading of the question, as both parts asked for the interest and not the amount they had after two years, resulted in mark loss for quite a number of candidates.

Answers: **(a)** 48.4(0) **(b)** 49.4(4) or 49.4(0)

Question 18

Many candidates did not attempt to draw any vector in part **(a)(i)** and also many were incorrect or too long. The coordinates of *L* were often correct even without the vector drawn. This mark was often gained by follow through from a marked incorrect point *L*. In part **(b)** many gained a mark by correctly multiplying the vector by 2 but the error of only multiplying the first component was often seen. Many could not interpret this to the diagram in order to find the correct coordinates.

Answers: **(a)(i)** Vector from (2, –3) to (0, 2) **(a)(ii)** (0, 2) **(b)** (2, 0)

Question 19

Although many candidates did not attempt this question it was not felt that this was due to lack of time. Otherwise the first part was well answered with most understanding that speed is distance divided by time. Unfortunately 900/20 was often seen without the division being done. Part **(a)(ii)** was not well done with many candidates confused about how to convert to other units. Attempts to go back to the graph and identify 0.9 kilometres and $\frac{1}{3}$ hour were not often successful. Many gained a mark in part **(b)** for recognising the need to divide a distance by a time but lack of knowledge of conversions lost the other mark. 30 minutes was often stated as 0.3 hour and 1600 metres was often 16 kilometres. However, this was a question where the better candidates scored well.

Answers: **(a)(i)** 45 **(a)(ii)** 2.7 **(b)** 3.2

MATHEMATICS

Paper 0580/02
Paper 2 (Extended)

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability. The paper was again challenging for the most able this year with fewer candidates scoring over 65 marks and very few scoring full marks. There was no evidence at all that candidates were short of time. The general level of performance was about the same as last year with most candidates finding some questions that they could do. A few Examiners reported a considerable number of candidates who should have been entered for the Core paper. Failure to show working was a major concern this year and candidates need to be aware that they should be showing even more working when asked to show something is an answer.

Particular Comments

Question 1

This was generally very well answered by all but the weakest candidates. The few candidates who made errors with their calculator were usually able to round their answer correctly.

Answers: **(a)** 4.25957(744…) **(b)** 4.3

Question 2

Failure to show working was common. Some candidates tried to convert from standard form and made errors with the number of zeros. Those candidates who did show working and gained some credit often were able to square V correctly but not then divide by R. The incorrect answer 5×10^{20} was very common.

Answer: 5×10^{4}

Question 3

This was generally very well done. A few candidates failed to take the shading into account in **part (b)**.

Answers: **(a)** 4 **(b)** 0

Question 4

This was very well answered. Quite a number of candidates misunderstood the meaning of the inequality sign and had their answers reversed.

Answer: x^2 $\cos x$ x^{-1}

Question 5

This question was found to be difficult by many candidates. They were unable to either work out the fractions on the left hand side or alternatively treat the question as an equation and clear the denominator.

Answer: 2

Question 6

This was poorly done with over half the candidates failing to score any marks. It was common to see 9.8923 rounded to 9 or 10.0000. It was also common to see 24.7777 rounded to 25, 20.0000 or 30.

Answers: **(a)** $\frac{0.003\times 3000}{(10\times 20)^2}$ **(b)** 0.01

Question 7

Candidates fully understood this question and how to solve it. Multiplication of the equations was usually correct but many candidates this year had great difficulty with the addition or subtraction phase of the solution, often subtracting one side and adding the other. One of the causes of mistakes was often the presentation of the working and the use of the answer space. Checking of answers would alert candidates to arithmetic errors.

Answer: $x = 2$ $y = -6$

Question 8

About half of the candidates answered this correctly. **Part (a)** was correct more often than **part (b)**. A few candidates failed to understand the meaning of the word exact. Other common errors were to divide 20000 by 14020 in **part (a)** and failing to subtract from 14020 in **part (b)**.

Answers: **(a)** 0.701 **(b)** 190

Question 9

The question was not well answered. Less than half the candidates were able to expand $(x + p)^2$ correctly and $x^2 + p^2$ was the common error. Many others tried to treat it as an equation and use the formula to "solve" it.

Answers: $p = 2$ $q = -12$

Question 10

Most candidates knew what was required and almost always used the area formula rather than the circumference. The main problems with this were either failing to halve the area of the circle, using the diameter instead of the radius or adding the areas instead of subtracting them. This was another question where some candidates failed to show enough working to score any marks when their answer was wrong.

Answer: 170

Question 11

This question was not well answered. Well under half the candidates were able to start with $M = kr^3$, even when they knew this was the method. $M= kr^2$ was the most common error, with other candidates thinking that the inverse power was required.

Answer: 100

Question 12

Very few candidates are able to use set notation. Many candidates do not know all the symbols in the syllabus and seemed to be guessing or inventing their own notation.

Answers: **(a)** Ø **(b)** ξ **(c)** *A*

Question 13

This was generally very badly done unlike the past few years. Only the more able candidates could answer this question correctly. A large number of candidates found the area instead of the perimeter while others found the perimeter first and then tried to find bounds for that value.

Answer: 28.2 28.6

Question 14

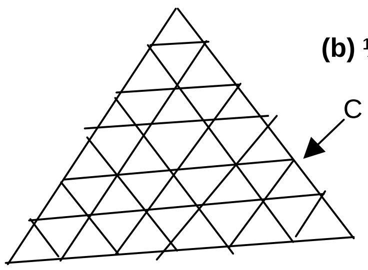
This question was surprisingly badly done by many candidates. Inability to deal with the zero was the most common problem in **part (a)** and 3 x 0 = 3 was the most common error closely followed by not multiplying the 9 by 3 when attempting to clear the denominator. The much easier method of adding 9 first was hardly ever seen. In **part (b)** large numbers of candidates either used the formula badly or could not factorise the quadratic correctly.

Answers: **(a)** 13.5 **(b)** –1 or 4

Question 15

Many candidates are beginning to show better understanding of vectors but the $-\frac{1}{2}\mathbf{a}$ term in **part (c)** was often the only mark scored. It remains, however, a question that many could not answer. Other problems are lack of working and failure to simplify terms.

Answers: **(a)**



(b) $\frac{1}{2}\mathbf{a} + \frac{1}{3}\mathbf{b}$ **(c)** $-\frac{1}{2}\mathbf{a} + \frac{2}{3}\mathbf{b}$

Question 16

Many candidates were able to produce an 8 but often the working was poor or not related to the problem. Many candidates failed to find the volume scale factor and take its cube root in order to show the relationship between the lengths. This then continued in **part (b)** where the 8 needed to be squared in order to find the relation between the areas.

Answers: **(b)** 1.12

Question 17

This was generally well answered with very few candidates scoring no marks. Failure to square correctly was a surprisingly common problem, usually involving the 6. Most candidates scored at least 2 marks.

Answer: $\sqrt{(36/T^2 - 1)}$ or equivalent form

Question 18

This was reasonably well attempted but very few candidates scored all 4 marks, usually due to failing to read the question in **part (a)**, trying to find an intercept in **part (b)** and using a different gradient in **part (c)**. It was surprising to see so many answers trying to find the gradient from the co-ordinate (3, 1).

Answers: **(a)** – 4/5 **(b)** $y = -(4/5)x$ **(c)** $-(4/5)x + 17/5$

Question 19

This was generally well done. The working in **part (b)** was sometimes poorly set out or inadequate and the scales misread but most candidates knew what was required.

Answers: **(a)** 3.365 to 3.375 **(b)** 0.26 to 0.27 **(c)** 55, 56 or 57

Question 20

Examiners reported a wide variety of responses to this question. In many cases they found the question very well done except for **part (d)** where very few candidates realised that it was double the answer to **part (c)** and so 154 was a very common error giving the obtuse angle. Other Examiners found that very few candidates scored any marks, usually where they started off with 73° for **part (a)**, 33° for **part (b)**, showed no working and probably only got **part (c)** correct.

Answers: **(a)** 65° **(b)** 25° **(c)** 103° **(d)** 206°

Question 21

Most candidates scored 1 or 2 marks on this question. In **part (a)** either the 3 was correct or the x^2 but only the most able managed both. In **part (b)** candidates often got as far as 1/64 and could not continue. This topic remains a difficult one for the average candidate.

Answers: **(a)** $3x^2$ **(b)** – 6

Question 22

There were many, very good and fully correct answers, usually from the more able candidates. Some candidates could not tell the difference between $\mathbf{A}^2$ and 2**A**. Others did not understand that $\mathbf{A}^2 = \mathbf{A} \times \mathbf{A}$ and incorrectly squared each term in the matrix. Others had difficulty with the negative signs.

In **part (b)**, a large number of candidates tried to find $\mathbf{A}^{-1}$ and then multiply with **A**, producing many arithmetic errors and arriving at meaningless answers. Some tried the **A**/**A** = 1 approach which also proved unhelpful as the answer was usually written as 1.

Answers: **(a)** $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ **(b)** I

MATHEMATICS

Paper 0580/03
Paper 3 (Core)

General comments

The paper this year was felt to be comparable with previous years and enabled candidates the opportunity to demonstrate their knowledge of Mathematics in a positive way. The majority were able to use the allotted time to good effect and were able to complete the paper to the best of their ability with few questions not attempted. The standard of presentation and amount of working to show the methods used was generally good although, as usual, there is always room for improvement in this area. Working was considered essential in questions **4, 6(b)(ii), 7(b)(iii)**, and useful in questions **1(a)(iv), 1(b)(i), 7(a), 7(b)(iv), 8(b), 10(b)** and **10(c)**. Method marks were available in these questions. In question **9** the construction lines used to draw the loci should have been clear and obvious. Questions **5** and **7** proved to be the most demanding whilst questions **3, 6** and **10** were the high scoring questions. A detailed breakdown of individual questions follows.

Comments on specific questions

Question 1

(a) (i) A significant number of candidates did not add the frequencies as required, with 6 and 45 being common errors.

(ii) This was generally well answered although the common errors of 8 and 10 were seen.

(iii) This was generally well answered although the common error of 7.5 was seen.

(iv) The calculation of the mean was less successful with errors of 36/6, 270/6, 270/45, 45/6 and 45/35 all seen.

(b) (i) The completion of the pie chart proved difficult for many candidates. A significant number did not appreciate that the given table was to be used with 7/35 x 360 the expected method. Some candidates simply measured the angle of the remaining sector, adding no sectors to the chart.

(ii) If an angle had been calculated it was usually drawn accurately.

Answers: **(a)(i)** 35 **(a)(ii)** 7 **(a)(iii)** 8 **(a)(iv)** 7.71 **(b)(i)** 72 **(b)(ii)** correct line drawn

Question 2

The majority of candidates were able to demonstrate their knowledge of the given transformations but drew incorrect images due to a variety of common errors including incorrect use of the given scale.

(a) Translations were generally drawn but the vector used was often inverted or reversed.

(b) Correct reflections were often seen, but sometimes in the two axes or the line x= -1.

(c) Correct rotations, but about a variety of points, were seen.

(d) Enlargements with a scale factor of 3 or with centres of enlargement at (1,1) or (0,1) were often seen.

(e) Although enlargement was commonly correctly identified as the required transformation the correct scale factor of ½ was rarely stated.

Answers: **(a)** image at (-5,4) (-3,4) (-4,5) **(b)** image at (1,-3) (3,-3) (2,-4)
(c) image at (-1,-1) (-3,-1) (-2,-2) **(d)** image at (2,2) (6,2) (4,4)
(e) enlargement, scale factor of ½, centre of enlargement (0,0)

Question 3

(a) The table was generally completed correctly although a small number of candidates had problems with the negative numbers.

(b) The graph was correctly drawn by the majority of candidates although a significant number chose to draw in the first and second quadrants, or in the third and fourth quadrants. A number also drew a continuous curve in error.

(c) A significant number were unable to use the graph but correctly calculated the required value.

(d) Similar problems occurred with this table with some also changing the given values to negatives.

(e) This was generally well drawn.

(f) This was generally well answered with a follow through available.

Answers: **(a)** -6,-12,-36,36,12,6 **(b)** graph drawn **(c)** 1.7 **(d)** 36,9,0,9,36 **(e)** graph drawn
(f) 3.3 , 10.9

Question 4

(a) This was generally well answered. Correct substitution into the given formula was usually shown although the “1/2” was sometimes omitted or incorrectly applied in the subsequent calculation. A small minority ignored this given formula and used the simpler formula for the area of a circle. A significant number failed to give their answer correct to 3 significant figures.

(b) The use of the formula was less successful here. Although the correct substitution was again often seen, the transposition to find the required value for r was often incorrectly applied with the 5π causing most problems. The use of r = 200 was also seen.

(c) Changing the subject of this given formula proved difficult for many candidates. The transposition of the 5π again caused problems. The use of the square root was often incorrectly applied or omitted. Weaker candidates often were unable to attempt this part of the question.

Answers: **(a)** 70.7 **(b)** 5.05 **(c)** $r = \sqrt{(2A / 5\pi)}$

Question 5

The mathematical language used throughout this question was not always understood. Weaker candidates were unable to score many marks as a result.

(a) **(i)** This was the most successful part although common errors were -4 and 0.12

(ii) 7 was the most common answer although all values were seen.

(iii) This was generally correct although √7 was a common error.

(iv) This was the least successful part with 2 2/3 and 0.12 the common errors.

(b) Only the better candidates were able to answer this part fully correct. Common errors included partial answers such as 2x20 or 5x8, sums such as 3+37 or 10+30, the answer of “ 2 and 5”, or a list of prime numbers less than 40.

(c) Similar problems were seen in this part. Common errors included the use of non-primes such as 7+33,19+21 and 13+27, or incorrect addition such as 13+29.

Answers: **(a)(i)** -16 **(a)(ii)** 7 or 144 **(a)(iii)** 144 **(a)(iv)** $\sqrt{7}$ **(b)** 2x2x2x5 **(c)** 11 and 29, 17 and 23

Question 6

(a) (i) This was generally well answered although 0.78 and 50+28 were common errors.

(ii) This algebraic equivalent part was less successful with many answers including the value of 78.

(b) (i) This was generally well answered.

(ii) This part on solving the simultaneous equations was generally well answered and showed a marked improvement on previous years. The elimination was more popular although the substitution method was also used. The method marks were usually scored, although accuracy marks were often lost due to manipulation or arithmetic errors.

Answers: **(a)(i)** 78 **(a)(ii)** $5p + 4e$ **(b)(i)** $2x + 3y = 57$, $5x + y = 58$ **(b)(ii)** $x = 9$, $y = 13$

Question 7

(a) (i) A significant number did not appreciate that Pythagoras was the method to apply. Those who did often made the errors of $\sqrt{(3^2 + 1.5^2)}$ or $\sqrt{(3^2 + 3^2)}$. Although the use of trigonometric ratios is a valid method it was rarely applied correctly. Truncation to 2.59 was seen.

(ii) On a follow-through basis, this part was better answered, although the full range of incorrect formulae were seen often involving circles.

(iii) Again marks were scored on a follow-through basis but the use of 3x3x8 was a common error. It was felt, however, that a significant number of candidates failed to see the connections between the three sections of part **(a)**

(b) (i) Very few candidates produced a correct solution here. Just a small number were able to show that 9 prisms fitted into the cross-section of the box, and that the length of the box was twice the length of the prism, allowing 18 prisms to be placed in the box.

(ii) This was generally well done, although a small number did not understand the word "net" and drew a three-dimensional sketch. The other common error was to draw a net consisting of a rectangle, 2 triangles and 2 trapezia.

(iii) This part caused a great deal of difficulty. Many candidates did not appreciate the connection with this area and the net drawn in part **(b)(ii).** Calculation of the triangular areas caused further problems with very few candidates realising that they could use 9 x their **(a)(ii)**. Method marks were available throughout.

(iv) This part was more successful although 540 / 6 was a common error.

Answers: **(a)(i)** 2.60 **(a)(ii)** 3.90 **(a)(iii)** 31.2 **(b)(i)** 18 **(b)(ii)** net **(b)(iii)** 502 **(b)(iv)** 32.40

Question 8

(a) The calculation of the required probabilities from the given table of values caused a number of problems for all but the better candidates. Answers greater than 1 were commonly seen.

(b) This was generally well answered.

(c) (i) The plotting was generally correct with just the occasional slip. A small number did not attempt this part.

(ii) The concept of a line of best fit was poorly understood with many candidates simply threading a line joining all the crosses plotted.

(iii) Those who had drawn a correct line in part **(ii)** were usually correct in the type of correlation stated. A significant few were also able to identify the correlation from their grid in part **(i).** However, a large variety of incorrect answers was also seen.

Answers: **(a)(i)** 10/12 or 5/6 **(a)(ii)** 4/12 or 1/3 **(a)(iii)** 12/12 or 1 **(b)** 10.5
(c)(i) 12 points plotted correctly **(c)(ii)** correct line drawn **(c)(iii)** negative

Question 9

This question was generally well answered by candidates who could demonstrate their knowledge of constructions and loci. However, a significant number were unable to score many marks. A smaller number were unable to attempt the question.

(a) (i) The correct arc was often omitted, inaccurate or with a wrong scale of 1 cm to 100 m used.

(ii) This was generally well answered with construction lines shown.

(iii) This was poorly answered with *R* often marked simply at the midpoint of the line *PQ*.

(iv) Using a follow-through basis this part was more successful but again the scale was either incorrectly or not applied.

(b) This proved to be the more difficult construction with little evidence of correct arcs being used.

(c) Those candidates with a correct diagram were generally successful.

Answers: **(a)(i)** correct arc **(a)(ii)** correct locus **(a)(iii)** *R* labelled **(a)(iv)** 640 to 700 m
(b) correct locus **(c)** correct shading

Question 10

(a) This was generally well answered with the number of dots being most successful. Some arithmetic errors were made.

(b) Few candidates were able to give a correct generalised algebraic answer in terms of n for this part. Numerical answers were common.

(c) This part was slightly better answered. Common errors included the incorrect substitution of 287 into the given expression and incorrectly using 287 dots.

Answers: **(a)** 42,56 71,97 **(b)** $n(n+1)$ **(c)** 12

MATHEMATICS

Paper 0580/04

Paper 4 (Extended)

General comments

Overall this paper proved more difficult to candidates than in previous years. However, most candidates were able to attempt all questions. The questions on arithmetic (percentages, ratio etc.), transformations, quadratic equations and constructions were generally well received and the sequence question at the end was well done in parts. The questions on functions, 3–D trigonometry, discrete data statistics, probability, interpretation of graphs and use of algebra in problem solving produced mixed responses.

There were some excellent scripts, scoring high marks and many candidates were appropriately entered at Extended tier and achieved success. There were, however, still substantial numbers entered for the wrong tier. They found this paper too challenging and would have had a better experience and more success with the Core exam. Candidates appeared to have sufficient time to complete the paper and omissions were due to difficulty with the questions rather than lack of time. The use of at least three significant figure accuracy unless specified was not noted by all candidates this year and accuracy marks were lost in **Questions 4** and **5** particularly. There were a number also losing accuracy marks by premature approximation particularly in **Questions 3** and **5** and Centres must be advised to be aware of the risks candidates are taking by continuously rounding off in longer questions when values are required in later parts.

Most candidates followed all the rubric instructions but it is worth offering reminders that all working and answers should be together. Candidates should be discouraged from writing answers in two columns on their answer paper. For questions requiring graph paper, 2 mm graph paper should be used and these questions should be answered entirely on the graph paper. Other varieties of graph paper can disadvantage candidates and cause problems in scaling.

A final point to make is that the number of marks allocated for a question can be a good guide as to how much work is required for that question. For example, **Question 5** included three trigonometry calculations in right-angled triangles, carrying 2, 2 and 3 marks. Many candidates used the sine and cosine rules which always carry more than 2 marks each.

Comments on specific questions

Section A

Question 1

The parts on percentages, ratio and the calculation of a total amount of money were well done, but the final part requiring an algebraic approach was badly done, suggesting difficulties in changing between different areas of mathematics in the same question.

The majority of candidates were able to answer **part (a)(i)** correctly although a number did increase $385 by 10% rather than decrease it by 10%. **Part (a)(ii)** proved more difficult and many did not use a reverse percentage method and reductions by 10% giving $346.5 were very common.

Parts (b)(i) and **(ii)** were very well answered but many were unable to find the % profit in **part (iii)**. A common error here was to use a fraction with $430 as the denominator rather than the original cost of $410.

In the final part of this question, trial and improvement appeared to be the favoured approach by many. For some, this was successful and those that gave 55 as their answer scored all 4 marks; for others this method was not successful and method marks were not available for trial and improvement methods. The more able adopted an algebraic approach setting up either a linear equation or a pair of simultaneous equations before solving. This approach even when unsuccessful gained part marks for method.

Answers: **(a)(i)** \$346.50, **(ii)** \$350 ; **(b)(i)** 115, **(ii)** \$430, **(iii)** 4.88 ; **(c)** 55.

Question 2

Part (a) proved to be very challenging to candidates and there were issues for some on understanding the terms mean, mode and median with answers to **part (a)(i)**, **(ii)** and **(iii)** being interchanged. The mode in **part (i)** was the best answered of the averages although a few confused their answers by giving the frequency of 7 as well as the grade of 6. Some gave 4 as the mode, however, presumably because it appeared on the grid most often. Most candidates were unable to obtain the median and the common error was to give an answer of 4, which was the middle grade on the table but did not take into account the frequencies. Many were able to use a correct method to find the mean but answers of 4.5 were common and candidates should note that at least three significant figure accuracy in answers is required. Other common errors involved division by 7 rather than the total frequency of 28.

Only a few candidates were successful with **parts (iv)**, **(v)** and **(vi)** and those that were successful with **part (iv)** invariably answered **parts (v)** and **(vi)** correctly as well. Most did not consider the dependent probabilities for the second student after the first student had been chosen and gave both fractions out of 28 before finding the product.

Many others were unable to obtain any accurate probabilities for grade 5 using the frequencies in the table.

Part (b) was answered more successfully and many were able correctly to find the product of 0.1 and 0.8 in **part (i)**. **Part (ii)** proved more difficult and a common error was to add 0.05 to their answer to **(b)(i)**. The final part was answered very well with most candidates able to use their answer to **part (ii)** with the 56 days and a follow through mark was allowed.

Answers: **(a)(i)** 6, **(ii)** 4.5, **(iii)** 4.54, **(iv)** $\frac{1}{63}$, **(v)** $\frac{1}{35}$, **(vi)** $\frac{92}{819}$; **b)(i)** 0.08, **(ii)** 0.125, **(iii)** 7.

Question 3

This question was generally challenging for many candidates, and although the topic tested is a familiar one, perhaps the unfamiliar style of the question put candidates off. The most able, however, were successful generally with all parts up to **part (f)**.

The first part of the question appeared straightforward but a large number of candidates were unable to give coordinate answers as specifically requested in the question. In **part (b)**, unfamiliarity with $y = mx + c$ led to many attempting a calculation for the gradient rather than recognising the coefficient of x as the gradient.

In **parts (c)** and **(d)**, there were often omissions although some only gave a subset of the x values that were less than 0 in **part (c)**. In **part (e)** the majority of candidates attempted to use the quadratic formula, and many were successful in obtaining the roots; for others, there were errors in either recalling the formula or the initial substitution. The most common error however was to either give the answers to the wrong accuracy or to prematurely approximate the $\sqrt{13}$ to 3.61 before dividing by 2 resulting in answers of -2.31 and 1.31.

Part (f) was often omitted and for those that attempted this most did not make the link between the roots in **part (e)** for the coordinates of A and B and the midpoint of AB.

Answers: **(a)(i)** (0, 1), **(ii)** (4, 0) and (0, 4) ; **(b)** –1; **(c)** $x < 0$; **(d)** $x^2 + 1 = 4 - x$; **(e)** **-**2.30 and 1.30 ; **(f)** (- 0.5, 4.5).

Question 4

There were many excellent answers to this question scoring full marks. For some, **parts (b)** and **(c)** proved too difficult.

Part (a) was very well answered. The majority were able to substitute correctly into the given formulae and then evaluate. There were occasional slips with the power of 3 in **part (ii)**.

Part (b) was harder for candidates but most attempted correctly to find the volume of the cylinder in diagram 1. A few used an incorrect formula to do this and were unable to make further progress in this part as a result. Many then made the link to **part (a)** adding the volumes of the two spheres to the volume of the cylinder. Errors at this stage included adding two surface areas from **part (a)(i)** or adding just one sphere instead of two. The final stage of division by the area of the cross-section then followed. For some candidates, all method marks were earned but then an answer of 9.8 was given when at least three significant figures are required.

In **part (c)**, there were many excellent attempts to reverse the steps before cube rooting. Common errors made by candidates included multiplying by 4.8 instead of dividing to obtain the volume of the sphere and taking the square root rather than the cube root after successfully reversing the steps. Again some candidates gave two significant figure answers of 3.7 thus losing the accuracy mark.

Answers: **(a)(i)** 154, **(ii)** 180, **(iii)** 1005 to 1006 or 1008 (1010) ; **(b)** 9.78 to 9.79 ; **(c)** 3.67 to 3.68.

Question 5

Candidates generally showed some understanding of trigonometric techniques but many found the 3D trig aspect in **part (c)** difficult. Very few candidates had their calculators in the wrong mode this year and calculations where rads or grads were used were rarely seen.

Part (a) was well attempted, most understood that Pythagoras theorem was the best method although weaker candidates added the squares of the sides rather than subtracted. A large number of candidates gave answers of 5.7 and 6.3 when three significant figures or better are required and where these values were used in later parts, accuracy was also affected. In **part (b)** many were able to correctly calculate the areas of the rectangle and the four triangles before adding. Some missed out one or two of the triangle areas however and a few weaker candidates did not understand the meaning of surface area.

In **part (c)**, it was essential that candidates used the **given** information on the pyramid to justify correctly the height of 4.90. Many used approximate values from their answers to **part (a)** and although they obtained a method mark the values used did not justify the height as 4.90 to two decimal places.

The more able candidates did well with **parts (ii)**, **(iii)** and **(iv)** and were able to identify the correct triangles within the pyramid to use. Many, however, were unable to identify the triangles PNX or HPN correctly and used lengths of 7 cm within their trig method. Others used lengthy methods involving the cosine rule in **part (iii)** when angle properties of a triangle would have been better. In **part (iv)**, most candidates did identify the triangle PAX correctly and were able to calculate successfully the angle required.

In the final part, the majority had little understanding of the meaning of a plane of symmetry or mistakenly regarded the pyramid as having a square base and gave 4 planes of symmetry.

Answers: **(a)(i)** 5.74, **(ii)** 6.32 ; **(b)** 132 ; **(c)(ii)** 50.7 to 50.84, **(iii)** 78.3 to 79, **(iv)** 44.4 to 44.43, **(v)** PHN or PGM.

Question 6

This question caused problems in when to measure and when to calculate.

There were some excellent answers to **part (a)** with measurements accurate and compass use precise in the constructions.

The scale drawing in **part (a)**, appeared straightforward but a significant number candidates were unable to interpret the scale correctly to give the side lengths of 13 cm, 15 cm and 18 cm on their drawing and had much smaller versions of the intended plan. Follow through marks were allowed for the remainder of **part (a)** after inaccurate drawing of the garden. The measuring of the 80° angle was sometimes inaccurate as were the measuring of the angles *ADB* and *DCB* from the scale drawing and a number of candidates were not well practised in the use of a protractor. The angle *DCB* was overlooked by some candidates and for others, the supplement of the angle was given.

Many understood the constructions of the angle bisector and the perpendicular bisector in **parts (iii)** and **(iv)** and used compasses correctly. Others omitted arcs and earned partial credit for accurately drawn ruled lines. The shaded region depended on a reasonably accurate angle bisector and perpendicular bisector drawn in the previous parts.

Part (b) was not answered well. Candidates often used measured values from the scale drawing to attempt the trigonometric calculations when the given information on the original drawing should have been used. **Part (b)(i)** was the best answered and those that considered the sine rule for the angle *ADB* were able to apply it successfully. In **part (ii)**, the intention was that the candidates would first of all find angle *CDB* using parallel lines and their answer to **(b)(i)** and then use this angle within the cosine rule. Many did attempt to use the cosine rule but with either an incorrect angle or a measured angle.

For the area of the garden in **part (c)**, some tried to find the area of the trapezium but used measured lengths within the calculation. Others attempted to find the areas of the triangles *BCD* and *ABD* but again used measured angles. A few were successful in obtaining the area entirely by calculation.

Answers: **(b)(i)** 58.57 to 58.6, (**ii)** 20.3 to 20.35, **(iii)** 436 to 437.

Question 7

Most candidates were able to scale the axes correctly and to draw the triangle *T* from the coordinates given

Many successful attempts were seen at the reflection in **part (c)**, some however were unable to draw the mirror line of $y = x$ correctly. Others were able to draw the line but then made either a vertical or a horizontal type reflection. The correct matrix was only occasionally seen and was often given with no working by those who recognised the reflection. Those candidates that attempted complex algebraic methods involving trying to match object and image points with an unknown matrix usually led to incomplete or incorrect answers. Using the unit vector is a good method for this type of question, although some candidates are able to recall the matrix from memory.

In **part (d)**, the enlargement was well drawn generally with candidates clearly using the matrix to halve the original coordinates. The description of the transformation was often partially correct but seldom completely correct with either the scale factor or centre of enlargement missed from the description. **Part (e)** was done well by the more able candidates, but was usually omitted by the majority.

Answers: **(c)(ii)** $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$; **(d)(ii)** enlargement, scale factor ½, centre (0, 0).

Question 8

Functions is a more demanding topic and whilst some questions may be quite predictable, there are always areas which are conceptually and algebraically quite difficult. Most candidates were able to score a few marks but only the most able gained high marks.

Many candidates were able to answer **part (a)** correctly although a few left answers as 1.5 for g(x) without then substituting 1.5 into f(x). In **part (b)**, there were many good answers beginning with the correct function substitution and then simplifying to a single fraction. A number of candidates left the numerator unsimplified. Some mistakenly did fg(x) or did the product of the two functions.

The inverse was not understood by many candidates. Those that correctly made the first step and subtracted 1 were often then unable to complete the rearrangement typically giving answers such as $\frac{x-1}{3}$.

Parts (d) and **(e)** had mixed responses. Many candidates showed appreciation of $2^3 = 8$ in **part (d)** but were unable to evaluate hh(3). In **part (e)** a correct substitution of $\frac{-24}{7}$ was often shown but often not in the form of the relationship h(x) = g($\frac{-24}{7}$). There were some that evaluated the expressions for g(x) correctly to $\frac{1}{8}$ to earn partial credit but then were unable to find the power of 2 required. Others converted the fraction $\frac{-24}{7}$ to a decimal leading to an evaluation that was not exactly $\frac{1}{8}$.

Answers: **(a)** 2 ; **(b)** $\frac{2+2x}{2x-1}$; **(c)** $\frac{3}{x-1}$; **(d)** 256 ; **(e)** -3.

Question 9

Parts of this question were very accessible and most candidates picked up marks for finding numerical values in sequences. The later parts were more algebraic and proved demanding. Only a few candidates had the insight to spot the pattern for the last of the sequences making the connection with the two rows above.

In **part (a)**, the first 5 values were usually successfully found. Some candidates found the next term of the sequence however and not the 8th term.

In **part (b)**, a number of candidates looked for arithmetical sequences for all parts of the question and only obtained the first part. Many recognised square numbers and powers of 3 but were unable to represent this as an nth term, and n^2 and 3^n were common errors in **parts (iv)** and **(v)**.

A good number of candidates obtained the method mark in **part (c)** for putting their answer to **(b)(i)** equal to -777 but errors in solving this equation were common.

In the final part, many recognised that they needed to find a power of 3 and were successful. Common errors involved answers of 11 and 59049 coming from 177147 divided by 3.

Answers: **(a)** 7, 512, $\frac{8}{9}$, 81, 2187, -2106 ; **(b)(i)** $9 - 2n$, **(ii)** n^3, **(iii)** $\frac{n}{n+1}$, **(iv)** $(n + 1)^2$, **(v)** 3^{n-1}, **(vi)** $(n + 1)^2 - 3^{n-1}$; **(c)** 393; **(d)** 12.